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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/080,222      | 02/21/2002  | Yiding Cao           |                     | 9754             |

7590 05/17/2004  
Yiding Cao  
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EXAMINER

CREPEAU, JONATHAN

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

1746

DATE MAILED: 05/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/080,222

Applicant(s)

CAO ET AL.

Examiner

Jonathan S. Crepeau

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 February 2002.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-17 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 2, 4-11, and 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Muthuswamy et al (U.S. Patent 6,060,188) in view of Corey et al (U.S. Patent 6,632,553).

Regarding claims 1 and 9, Muthuswamy et al. teach a tubular fuel cell comprising a circular membrane electrode assembly comprising an anode catalyst (26), cathode catalyst (24) and solid polymer electrolyte (25) (see Fig. 1). An air flow duct (22) is on the cathode side, and an annular fuel reservoir (28) is on the anode side (see Fig. 1). The fuel may comprise liquid methanol (see col. 4, line 20). Regarding claims 4, 6, 13, and 15, both flow chambers may contain a porous structure (see Fig. 4). Regarding claims 5, 7, 14, and 16, a thin layer of electrically conductive electrode diffusion material (e.g., metal fiber) (23, 27) is coated on the porous material (see col. 3, line 26). Regarding claim 9, a plurality of tubular fuel cells may be contained in the same housing (see Figure 6). Regarding claims 1 and 9, terminals are appropriately connected to the cell(s) (see col. 4, line 24).

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Muthuswamy et al. do not expressly teach a carbon dioxide relief valve as recited in claims 1, 8, 9, and 17, that the system comprises an external fuel tank and valve (claims 2 and 11), or that the terminals are connected in series (claim 10).

However, the artisan would be motivated to connect the terminals of the plurality of fuel cells of Muthuswamy together in series. Such an arrangement would serve to increase the voltage of the unit and is therefore considered to be obvious to a skilled artisan.

Further, Corey et al. is directed to a direct methanol fuel cell system. The system comprises an external fuel tank (39), a supply valve (56), and a carbon dioxide exhaust valve (36) (see Figure 3).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to incorporate the elements of Corey et al. into the system of Muthuswamy. In column 4, line 25, Muthuswamy teaches that “[t]ypically, the oxidant and fuel are introduced into one end of the cylinder and recovered or vented at the other end. However, additional inlets and outlets can be provided along the length of the cylinder in appropriate manifolding if desired, and still be considered to fall with the scope and spirit of our invention.” Furthermore, in column 2, line 61, Corey et al. teach the following:

According, the suitability of DMFC power systems for powering portable devices and consumer electronics is dependent upon the development of systems and methods for eliminating and/or recirculating the effluent products produced during operation of the fuel cell. In addition, in order for DMFC power systems to be used effectively, they must be self-regulating and passively generate electrical power under benign operating conditions, such as ambient air temperature and pressure.

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As the system of Corey et al. is self-regulating, the artisan would be motivated to incorporate the features of the system into the fuel cell of Muthuswamy et al. As such, the recitations of a carbon dioxide relief valve, an external fuel tank, and a supply valve would be rendered obvious to a skilled artisan.

3. Claim 3 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Muthuswamy et al. in view of Corey et al. as applied to claims 1, 2, 4-11, and 13-17 above, and further in view of McNicol et al (*J. Power Sources*, 1999).

Muthuswamy et al. do not expressly teach that the system comprises a control unit that applies a continuous instantaneous pulsed load cycle to the fuel cell, as recited in claims 3 and 12.

On page 24, second column, McNicol et al. teach that a continuous instantaneous pulsed load cycle is applied to a direct methanol fuel cell.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to apply the load cycle of McNicol et al. to the fuel cell of Muthuswamy et al. On page 24, second column, McNicol et al. teach that "switching the current off for short periods of time results in a return of the catalytic activity to its pseudo steady-state level. This fortunate observation encouraged Shell to conduct life test using various programmed on/off sequences; very little loss in activity

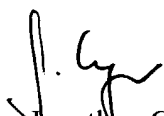
was observed over thousands of hours.” As such, the artisan would be motivated to apply the load cycle of McNicol et al. to the fuel cell of Muthuswamy et al.

### *Conclusion*

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Crepeau whose telephone number is (571) 272-1299. The examiner can normally be reached Monday-Friday from 9:30 AM - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski, can be reached at (571) 272-1302. The phone number for the organization where this application or proceeding is assigned is (571) 272-1700. Documents may be faxed to the central fax server at (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Jonathan Crepeau  
Patent Examiner  
Art Unit 1746  
May 13, 2004